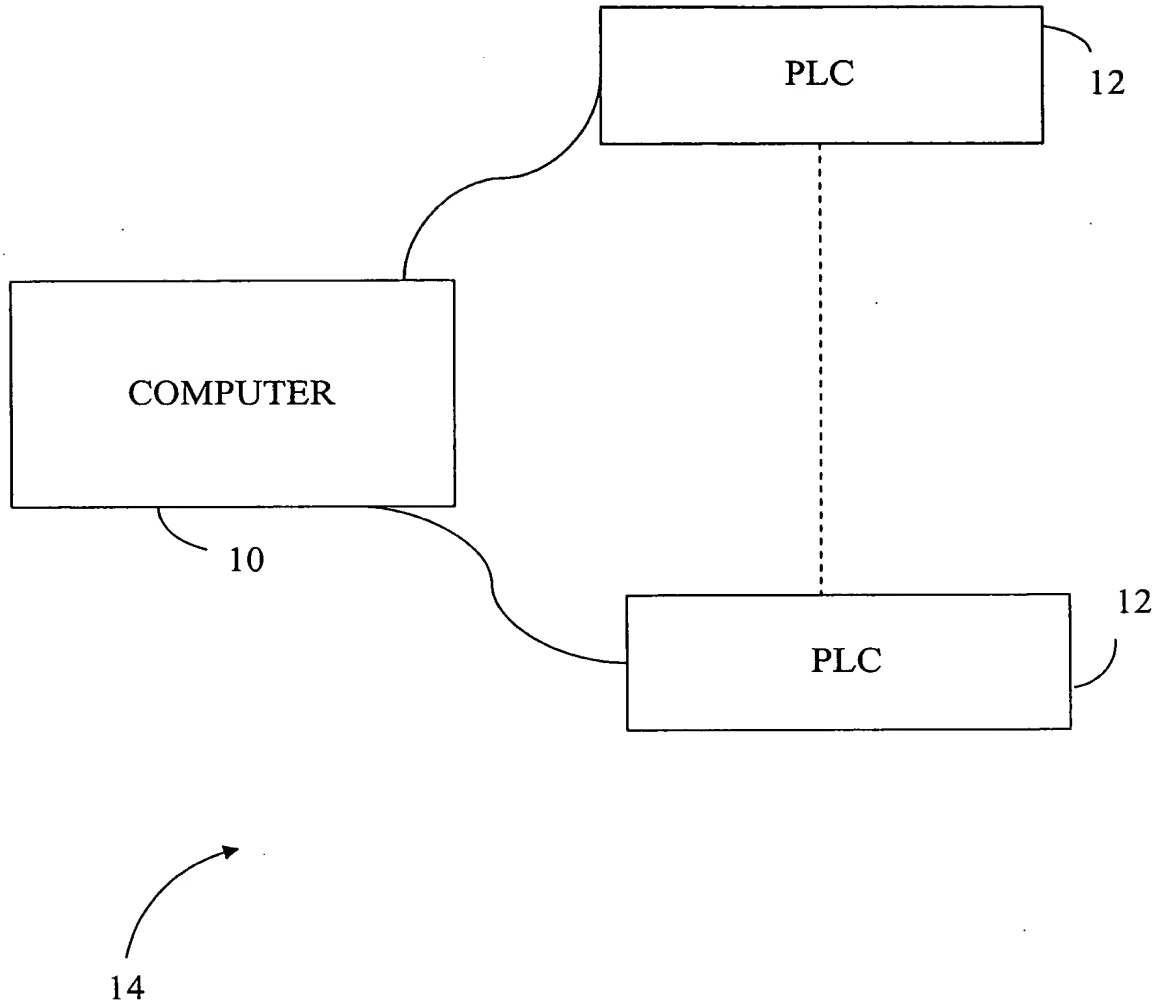


FIG. 1

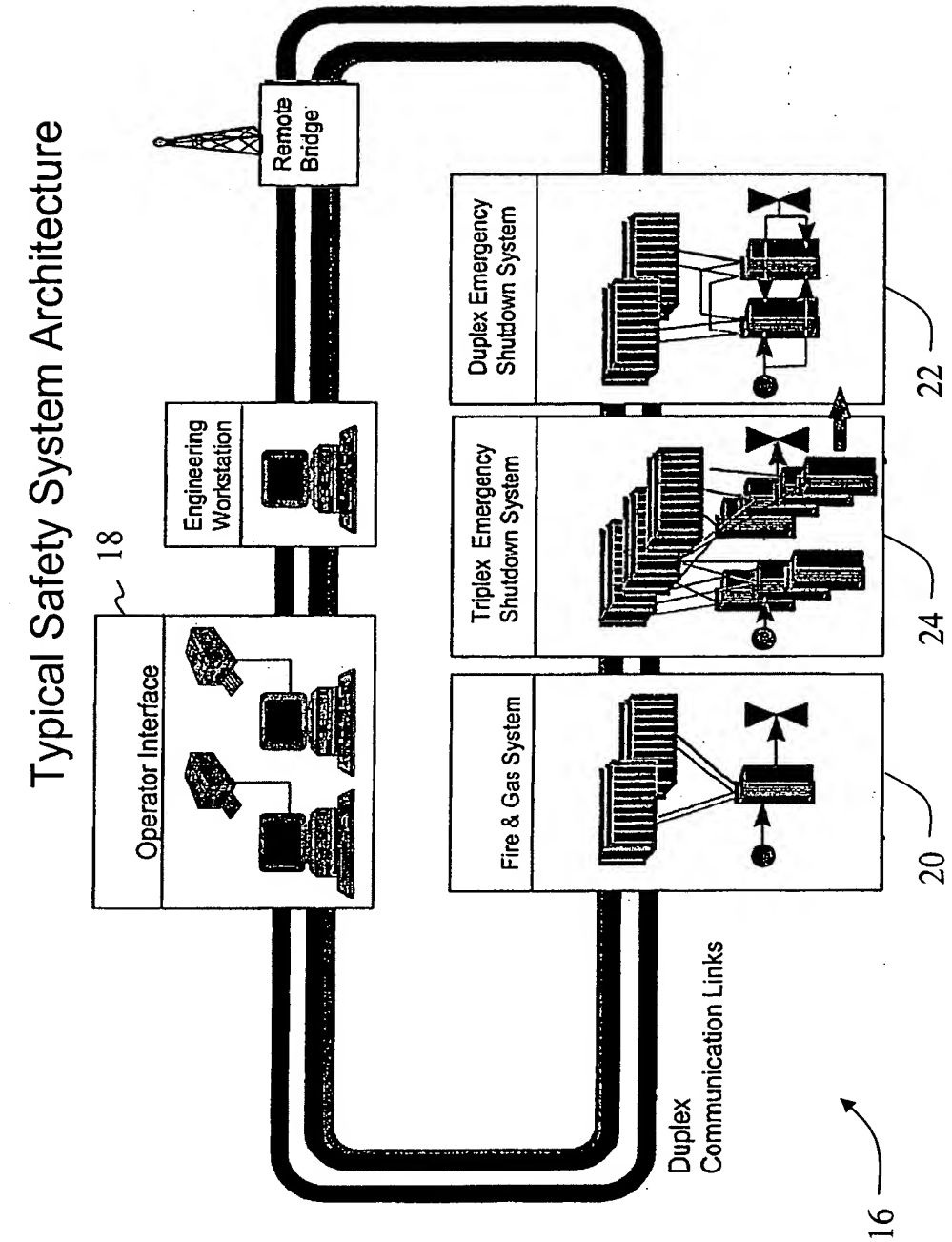


FIG. 2

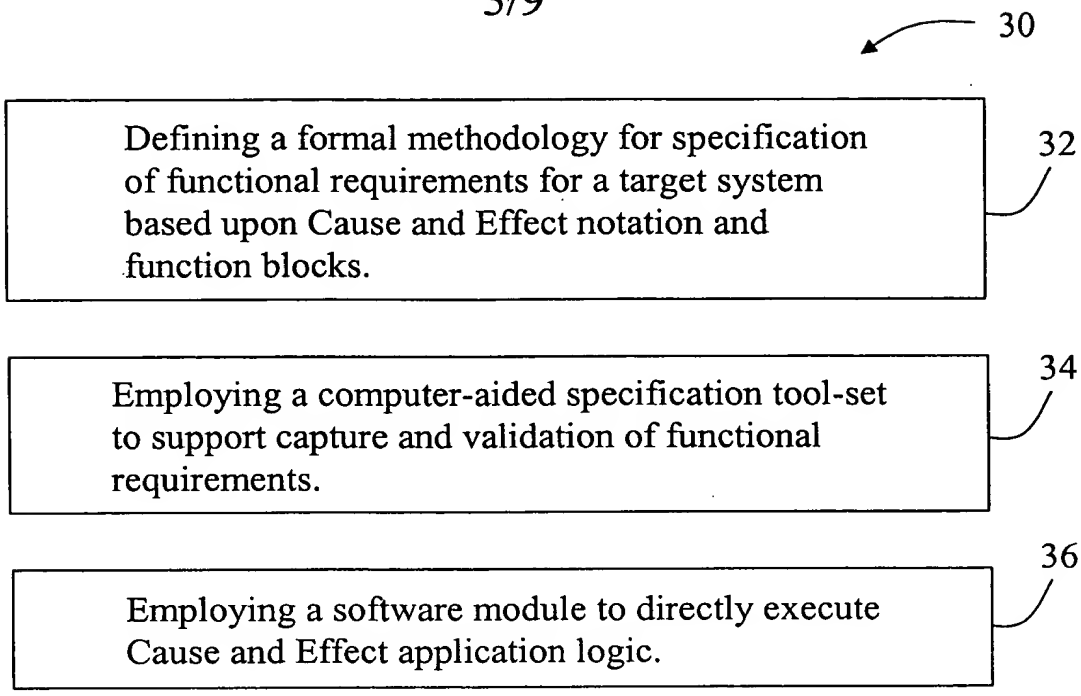

30
Defining a formal methodology for specification of functional requirements for a target system based upon Cause and Effect notation and function blocks.
32
Employing a computer-aided specification tool-set to support capture and validation of functional requirements.
34
Employing a software module to directly execute Cause and Effect application logic.
36

FIG. 3

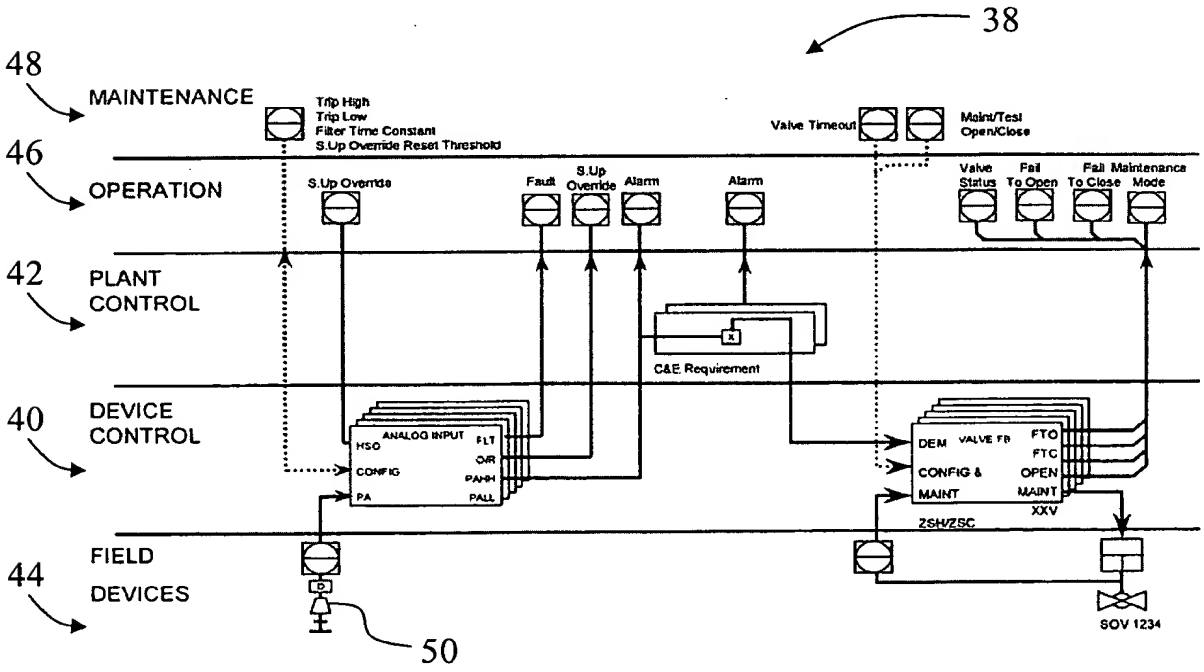

38
48
MAINTENANCE
46
OPERATION
42
PLANT CONTROL
40
DEVICE CONTROL
44
FIELD DEVICES
50
Trip High
Trip Low
Filter Time Constant
S.Up Override Reset Threshold
S.Up Override
Fault
S.Up Override
Alarm
Alarm
Valve Timeout
Maint/Test Open/Close
Valve Status
Fail To Open
Fail To Close
Maintenance Mode
C&E Requirement
ANALOG INPUT
HSO
CONFIG
PA
FLT
O/R
PAHH
PALL
DEM
VALVE FB
CONFIG &
MAINT
FTO
FTC
OPEN
MAINT
XXV
ZSH/ZSC
SOV 1234

FIG. 4

54

Symbol	Name	Description
X_n	OR	Input term is or'ed into Gate n
$\bar{X}_n$	INV OR	Input term is inverted and or'ed into Gate N
$\&_n$	AND	Input term is and'ed into Gate n
$\bar{\&}_n$	INV AND	Input term is inverted and and'ed into Gate n
E_n	ENABLE	Input term is or'ed with other enables. These terms are used to enable or'ed/and'ed terms of Gate n. If no enable terms are defined then gate is enabled.
$\bar{E}_n$	INV ENABLE	Input term is inverted and or'ed with other enables. These terms are used to enable or'ed/and'ed terms of Gate n. If no enable terms are defined then gate is enabled.
$T(NN)_n$	ONTIMER	Input term is subject to on delay of NN seconds. Timer output is or'ed into group n.
$\bar{T}(NN)_n$	INV ONTIMER	Input term is inverted and subject to on delay of NN seconds. Timer output is or'ed into group n.
R	RESET	Input term resets latch. Latch set term has priority. If no reset terms are defined for a gate then gate is non-latching.
$\bar{R}$	INV RESET	Input term resets latch when false. Latch set term has priority. If no reset terms are defined for a gate then gate is non-latching.

56 58 60 62 64 66 68 70 72 74

CAUSE & EFFECT INSTRUCTION SET SUMMARY

52

FIG. 5

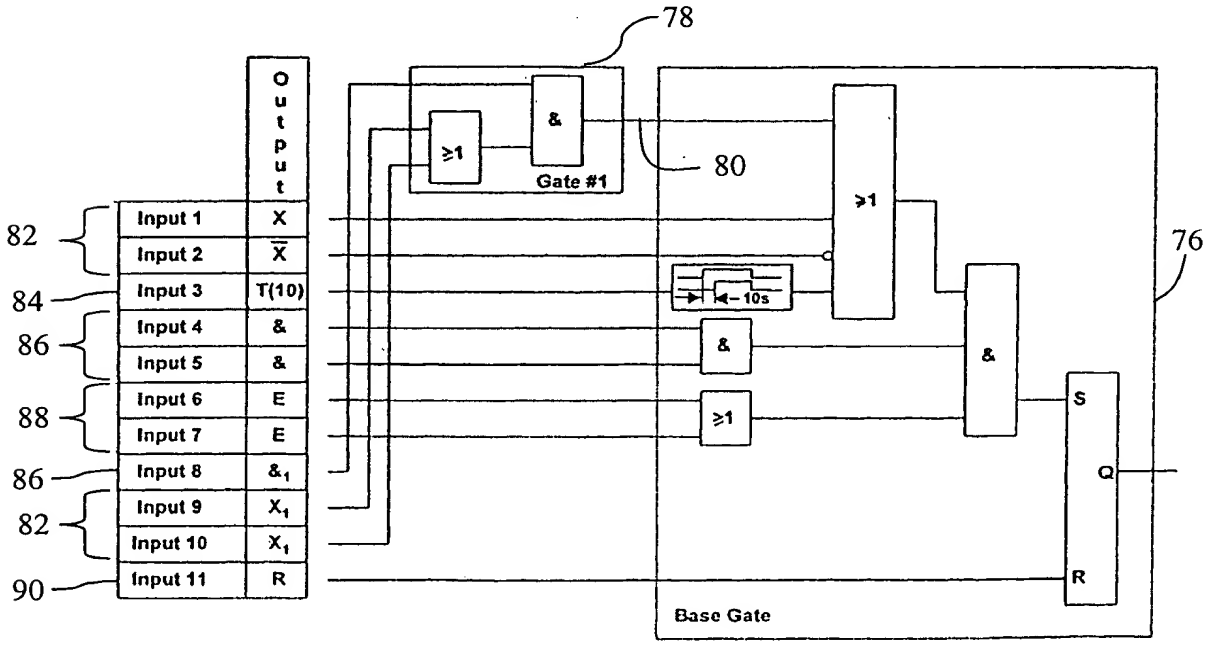


FIG. 6

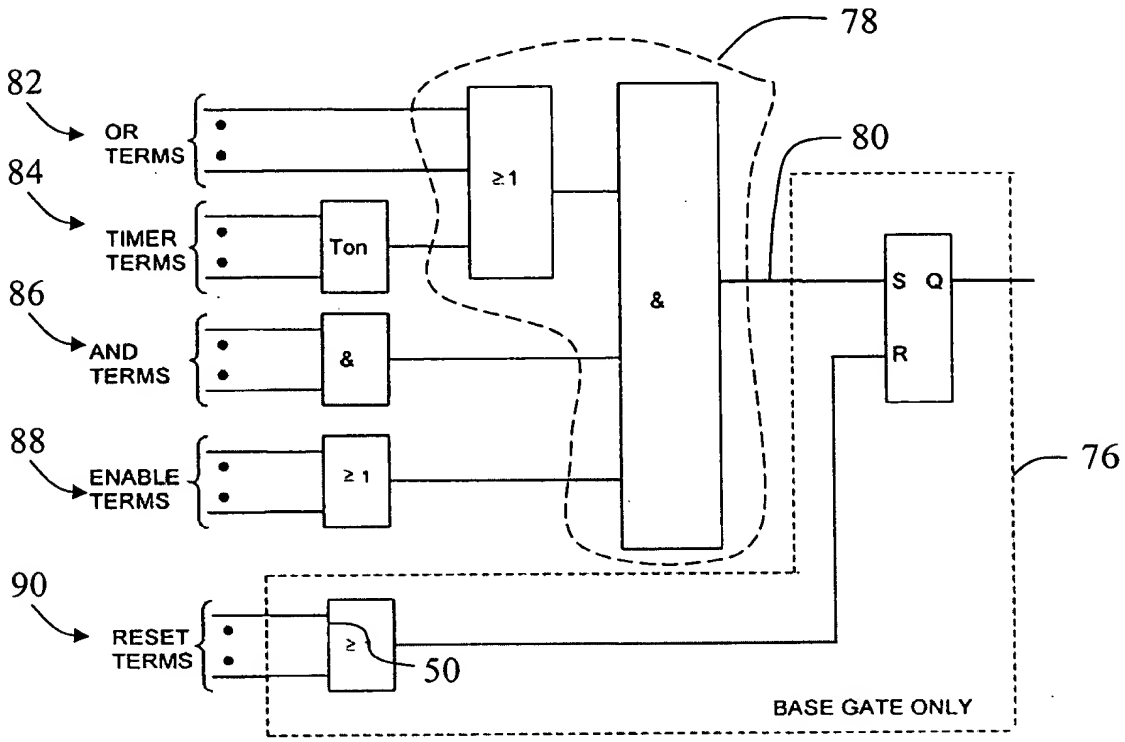

78
82
OR TERMS
84
TIMER TERMS
86
AND TERMS
88
ENABLE TERMS
90
RESET TERMS
≥1
Ton
&
≥1
&
80
S Q
R
76
≥1
50
BASE GATE ONLY

FIG. 7

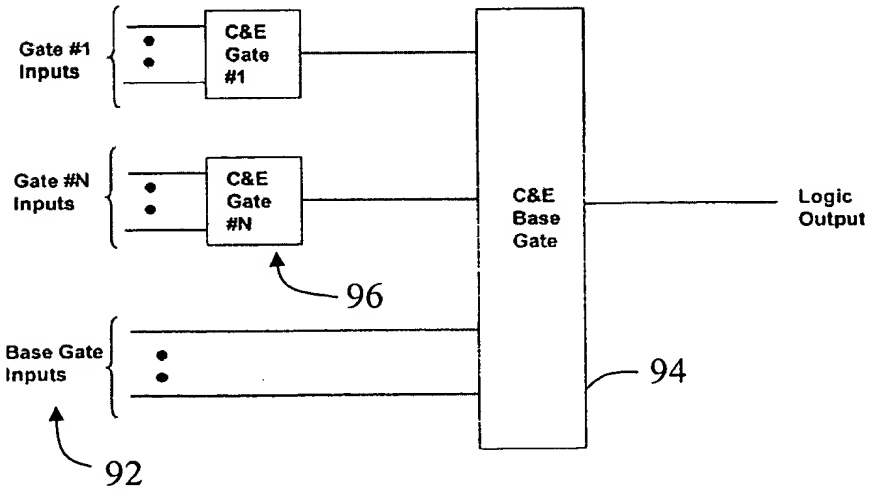

Gate #1 Inputs
C&E Gate #1
Gate #N Inputs
C&E Gate #N
96
Base Gate Inputs
92
C&E Base Gate
Logic Output
94

FIG. 8

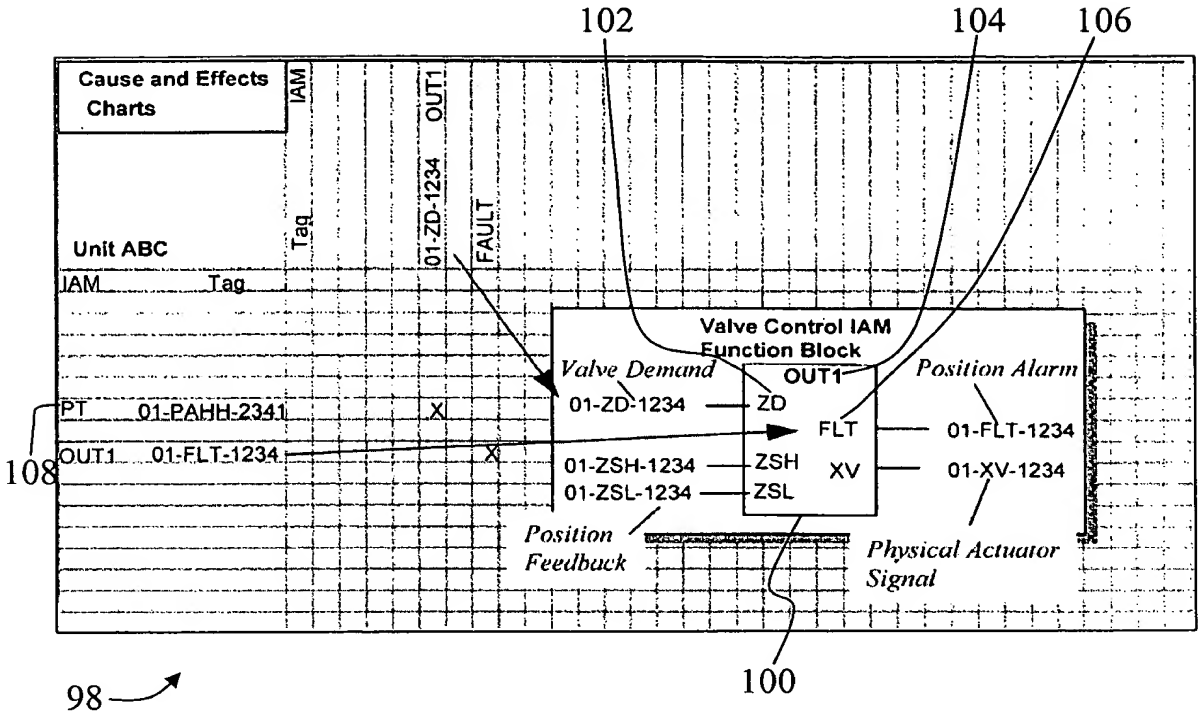

102
104
106
Cause and Effects Charts
IAM
OUT1
01-ZD-1234
FAULT
Tag
Unit ABC
IAM
Tag
Valve Control IAM Function Block
Valve Demand
OUT1
Position Alarm
PT
01-PAHH-2341
01-ZD-1234
ZD
FLT
01-FLT-1234
OUT1
01-FLT-1234
01-ZSH-1234
ZSH
XV
01-XV-1234
01-ZSL-1234
ZSL
Position Feedback
Physical Actuator Signal
108
98
100

FIG. 9

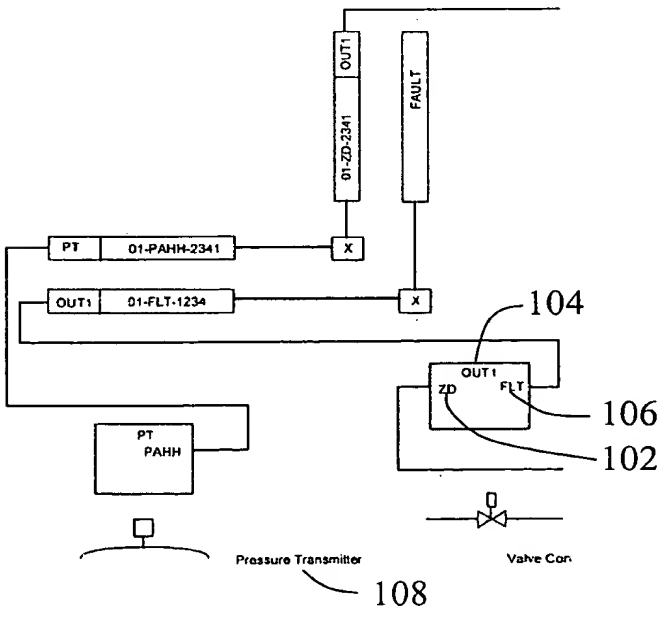

OUT1
01-ZD-2341
FAULT
PT
01-PAHH-2341
X
OUT1
01-FLT-1234
X
104
OUT1
ZD
FLT
106
102
PT
PAHH
Pressure Transmitter
Valve Con
108

FIG. 10

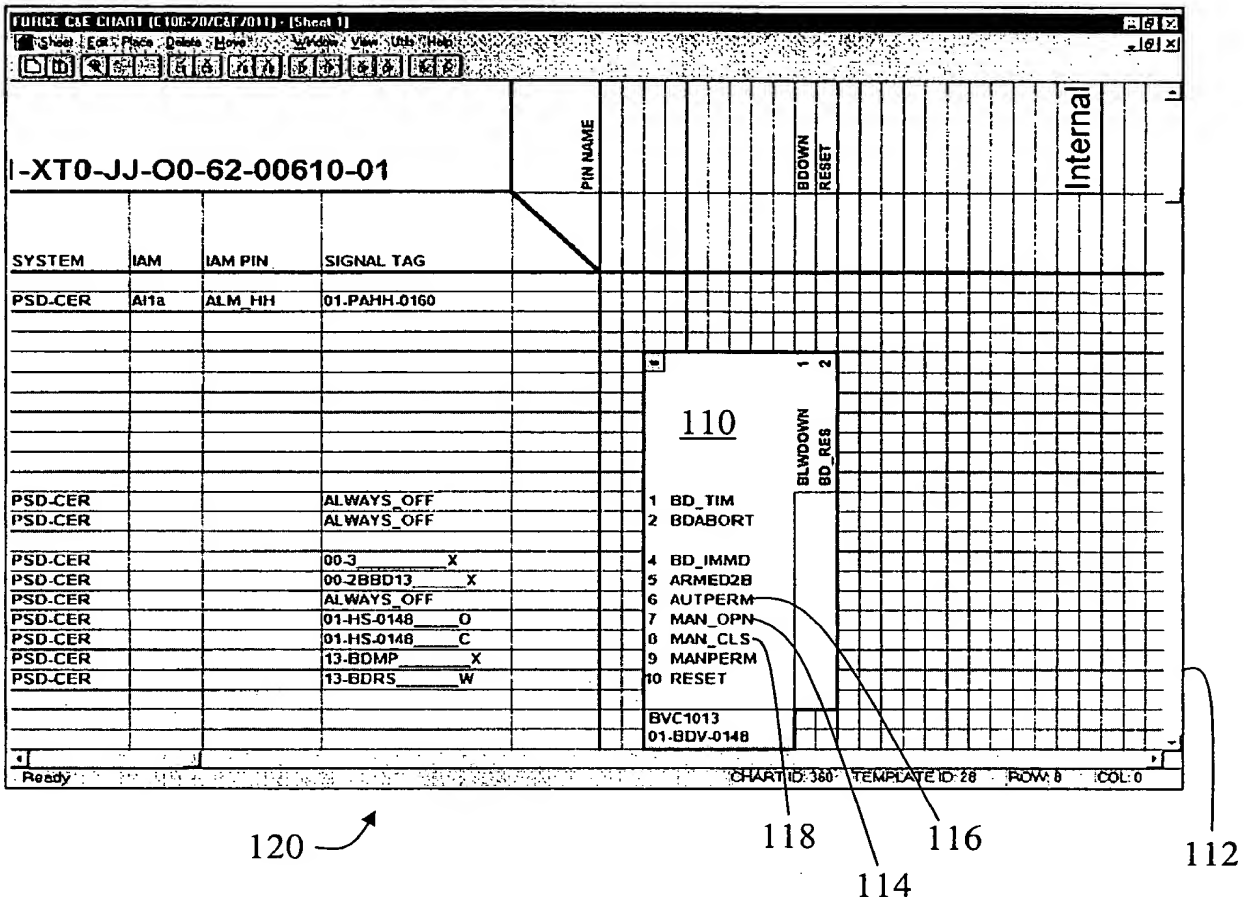

I-XT0-JJ-O0-62-00610-01
PIN NAME
BDOWN
RESET
Internal
SYSTEM
IAM
IAM PIN
SIGNAL TAG
PSD-CER
AI1a
ALM_HH
01.PAHH-0160
PSD-CER
ALWAYS_OFF
PSD-CER
ALWAYS_OFF
PSD-CER
00-3_____X
PSD-CER
00-2BBD13____X
PSD-CER
ALWAYS_OFF
PSD-CER
01-HS-0148____O
PSD-CER
01-HS-0148____C
PSD-CER
13-BDMP_____X
PSD-CER
13-BDRS_____W
110
BLWDOWN
BD_RES
1 BD_TIM
2 BDABORT
4 BD_IMMD
5 ARMED28
6 AUTPERM
7 MAN_OPN
8 MAN_CLS
9 MANPERM
10 RESET
BVC1013
01-BDV-0148
Ready
CHART ID: 360
TEMPLATE ID: 28
ROW: 8
COL: 0
120
118
116
114
112

FIG. 11

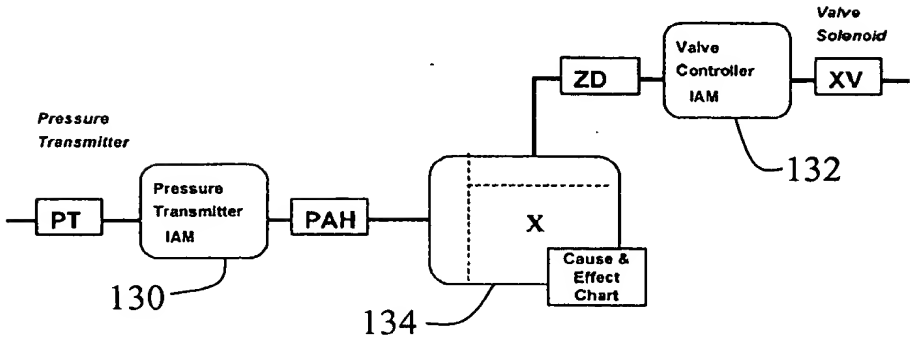

Pressure
Transmitter
PT
Pressure
Transmitter
IAM
130
PAH
X
Cause &
Effect
Chart
134
ZD
Valve
Controller
IAM
132
Valve
Solenoid
XV

FIG. 12

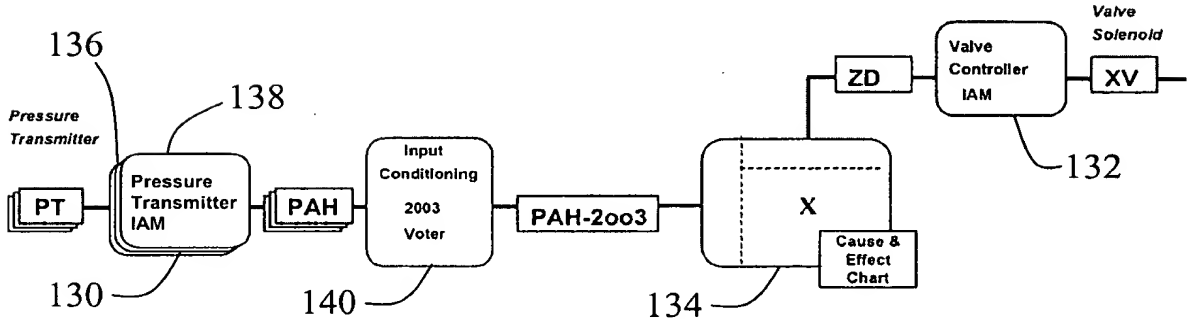
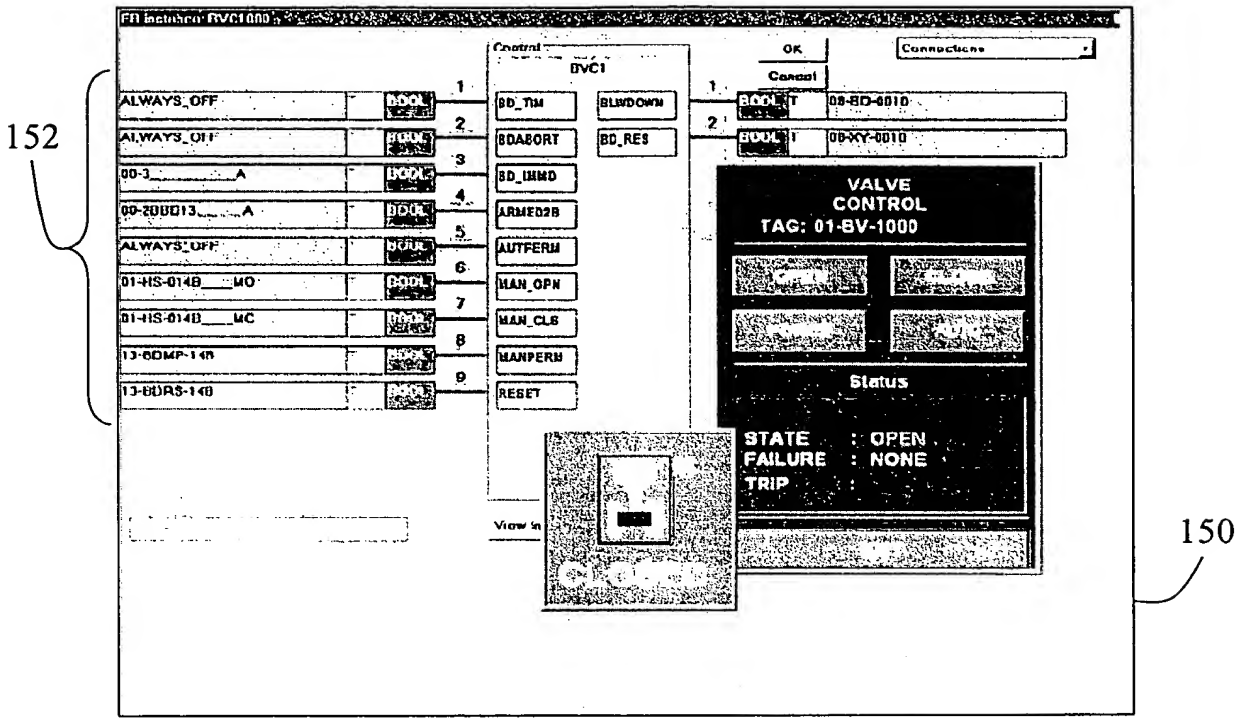

136
138
Pressure
Transmitter
PT
Pressure
Transmitter
IAM
130
PAH
Input
Conditioning
2003
Voter
140
PAH-2oo3
X
Cause &
Effect
Chart
134
ZD
Valve
Controller
IAM
132
Valve
Solenoid
XV

FIG. 13



FUNCTION BLOCK LOGIC TEMPLATE AND
ASSOCIATED HMI ELEMENTS

FIG. 14